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ABSTRACT

Regional networking and knowledge transfer are considered with a focus on partnerships between business and higher education institutions, conditions for successful strategic allegiances, and the consequences of networking for the higher education mission. The experiences of Utrecht University (the Netherlands) are used to illustrate how a higher education institution can anticipate new societal developments. Linear models and the interactive model for innovation are reviewed as frameworks for understanding the knowledge infrastructure. In addition to beginning with a long-term objective, strategic alliances need to have parallel strategies and must respect each other's mission. A region can either be local or crossing state or country borders. Knowledge and knowledge transfer will be a key factor in international competitiveness and higher education institutions can play an important role in national systems of innovations. A solid base is formed in regional networks due to proximity, the common home market, and the relatively uncomplicated management of the network. Participation in networks forces higher education institutions to define their focal points of research and education in a more explicit way. Networking does, however, affect the management structure of higher education institutions in that the traditional structure of faculties and departments will no longer be suitable. (Contains 13 references.) (SW)

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A REVOLUTION IN REGIONAL NETWORKING, LINKING THE KNOWLEDGE

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Jean Endo
Editor
AIR Forum Publications

ABSTRACT

Knowledge will be the key factor in international competitiveness and institutions of Higher Education (H.E.) will therefore play a significant role in national systems of innovation. The real 'linking pin' between higher education and the world of work seems to be regional. Recent studies in networking and knowledge transfer show the importance of co-operation between institutes of H.E., local and regional authorities, and industry. The paper gives an insight into key aspects that underlie successful networking of these very different institutions, from the perspectives of education, economic development and governance. The authors will also touch upon the importance of regional co-operation and the implications of networking for the mission of H.E. institutions.

1. Introduction

In a global economy, knowledge is becoming the most important factor in competing with other companies or countries. The importance of knowledge as a competitive factor for nations is extensively discussed in Dertouzos, Lester, Solow et al. (1989) and Branscomb (1991). Most OECD countries are increasing investments in research & development as well as in (higher) education. Michael Porter (1990) explains why companies have to broaden their strategies to invest not only in capital and labour but also in knowledge and innovation.

Products and services have shorter lifecycles and innovations have to ensure the viability of industry. That is why we can observe a shift from government expenditure on higher education towards the private sector where a new generation of managers refrains from the traditional cost-cutting 'lean and mean' scenarios. Modern corporations invest in knowledge through all kinds of partnerships and strategic alliances with other companies as well as H.E. institutions.
The most successful networks where knowledge transfer is at stake, seem to be regionally organized. Most H.E. institutions are already engaged in co-operation with regional partners, but this co-operation often has an 'ad hoc' character. Only recently, the scale of these networks is growing rapidly. The fact that companies subcontract large parts of their R&D efforts, and at the same time have to keep their work force trained up to the highest standards, is increasing the role of H.E. institutions in regional economic development.

Theories about networking and the processes that underlie successful co-operation are often restricted to an economic point of view. Furthermore, they often deal with co-operation between companies on a global scale and tend to focus on business-like features of that co-operation such as finance, distribution, logistics, and seldom on R&D and innovation.
Only recently, (Bennett 1990, Bennett & Krebs 1991, McKinsey & Company 1991, Charles & Howells, 1992, OECD 1992, Beije 1993), other perspec-

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tives have been added to these theories on networking. These studies include co-operation with regard to R&D and innovation and they indicate the importance of the region as an important aspect of co-operation between H.E. institutions, local authorities and industry. Furthermore they indicate that traditional views on knowledge transfer are inadequate because they overlook the complex, interactive, nature of co-operation.
Case studies (for example Van Terwisga & Van Rosmalen, 1992) give us more insight in the scope and organization of networks with innovating capacities.

In 'Made in America' (Dertouzos et al. 1989) the leaders of the MIT Commission on Industrial Productivity warn against this underestimation of the importance of human resources and basic research. In a rapidly changing (technological) environment, this can become a severe obstacle in trying to increase the competitiveness of enterprises. The importance of higher education as a major part of a nation's scientific and technological base is more and more recognized by the business community. See for example the Council on Competitiveness report "Gaining New Ground; Technology Priorities For America's Future" that identifies critical generic technologies driving the American economy and explains what government, labour, industry and institutions for H.E. must do to strenghten U.S. leadership. Similar reports by governments and/or business communities in other OECD countries stress that competitiveness in a global economy will more and more depend on investments in human capital and R&D.

In our paper, we will analyse the different aspects that are specifically important for networks dealing with knowledge transfer. We will focus on partnerships between businesses and H.E. institutions, conditions for successful strategic alliances, regional co-operation, and the consequences of networking for the H.E. mission. The experiences of Utrecht University will be used to illustrate how a H.E. institution can anticipate new developments in society.

2. Knowledge: infrastructure and transfer

Freeman (1988) introduces 'national systems of innovation' as an important part of the national infrastructure. There is a certain parallel in his way of thinking about innovation systems and the 'physical' infrastructure such as bridges, highways and railroads. The importance of infrastructure depends on how effective it is being used. For knowledge, it is extremely difficult to determine this effective use in an exact way, although nobody opposes the view that industrialized countries depend heavily upon their knowledge infrastructure. When generating new knowledge, the applications are often not within sight for many years. Basic research within one discipline often leads to innovations within other disciplines or technologies. When trying to solve problems related to product or process innovations, knowledge that is already available is often overlooked. Systems of innovation therefore are complex systems, involving many different parties with different roles in different processes. Thus, national innovation systems are to be understood as the national networks that produce and transfer knowledge, including national and regional (local) instruments used in order to facilitate the transfer.

In order to understand the transfer process and the relations between the knowledge infrastructure (that is H.E. institutions, research institutes, transfer agencies, other intermediaries) and the business community we must look into the innovation models that are often, rather implicitly, used in the literature on the subject.

2.1 Linear models

There is an overly 'linear' approach in most common views on the transfer of knowledge and technology that is reflected in many government and H.E. policy instruments. Within this linear approach, two models can be identified. The first is a technology-driven model, in which technological innovations are devised in a laboratory and then simply 'handed over' to a company that is able to fit them into a development process. The other is a market-driven model, in which a company buys or commissions the technology (or specific knowledge and

skills) it needs from a specialized institution.

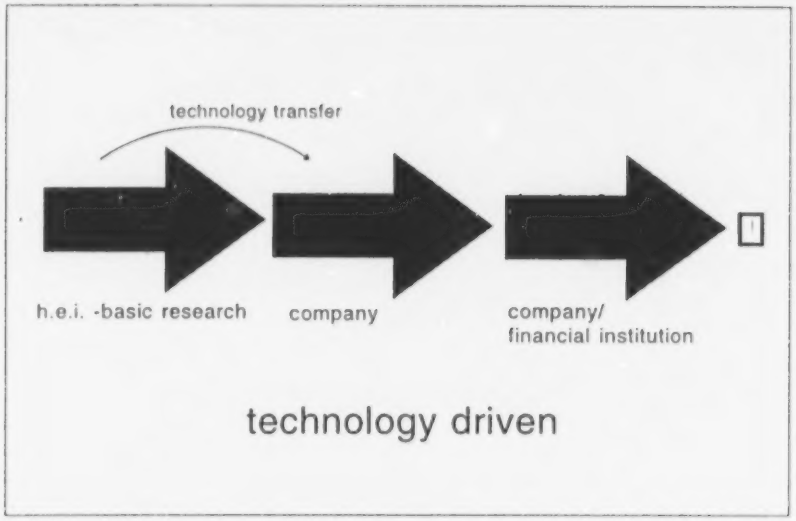

Figure 1: A linear model, technology driven

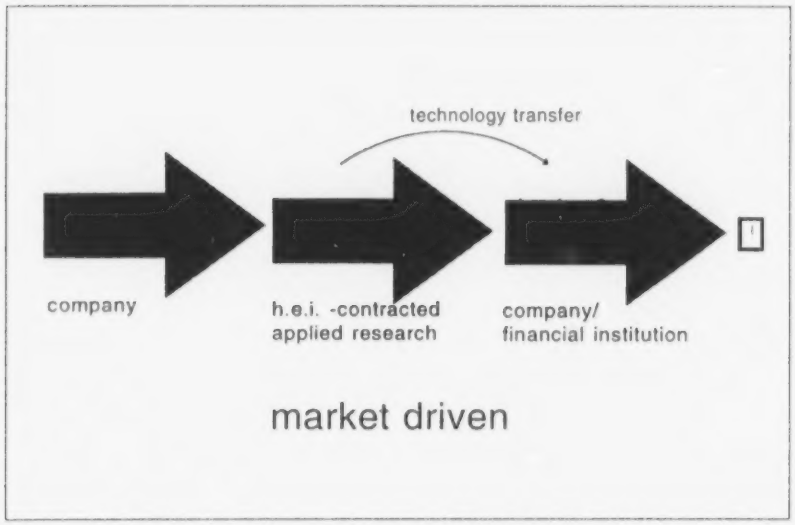

Figure 2: A linear model, market driven

Neither of the linear models can really explain the complicated aspects of knowledge transfer, as is shown clearly by McKinsey & Company (1991). The technology-driven model fails to take into account the fact that laboratory based innovations are seldom business-tailored concepts which can easily be developed further. The market-driven model involves the considerable danger that by the time the technology has been developed, the market will have moved on (and we have seen many examples of that in ever shorter product-life cycles) or the technology turns out to be too costly to commercialize. Even more important is the fact that in using linear models as described above, the market will never get beyond 'incremental' innovation, that is simply improving on what already exists. The market, or rather the customer, can hardly ask for products or services for which it is not certain that they are technically feasible. For example, consumer demands have improved audio and video products but the innovation from analogue to digital techniques was simply beyond the scope of consumers (and many producers for that matter).

2.2 The interactive model for innovation

McKinsey & Company (1991) therefore developed a more interactive model for successful innovation. This so called pre-eminently practical model, based on actual experience, is in a number of respects similar to the 'chain link' model developed by Kline and Rosenberg (1986).

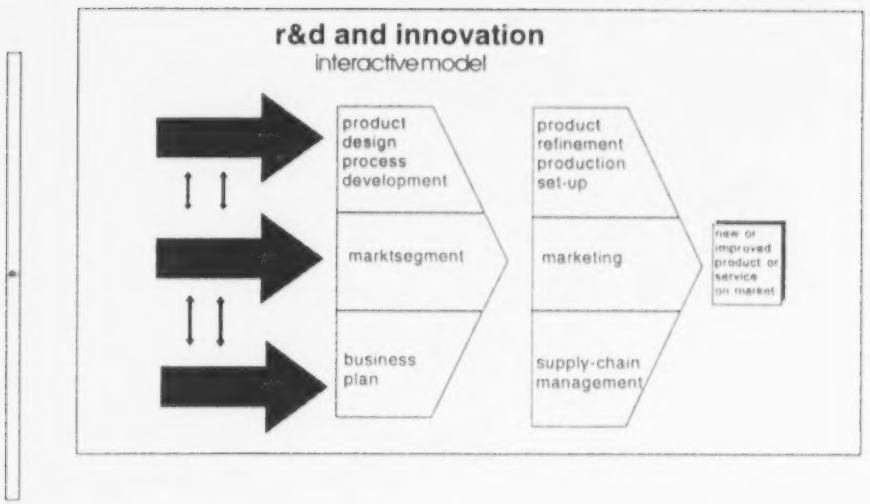

Figure 3: The interactive model (Mckinsey & Company, 1991)

In the McKinsey model, participants from both the academic and business communities are involved in partnership during each phase of the development and transfer process.

The first phase of the model conceptualizes the generation of the business concept, integrating three different kinds of insights:

- The different technological insights which create the potential for a new product or service; hese strategic technologies often originate from different sources - academic and industry - and innovation arises at an interdisciplinary level
- The insights into market needs, including latent, even unspecified, customer demands.
- The business economic insights which understand how the technology will add real value in a properly funded and profitable business.

We know from our own experiences that this phase, in most cases, is pre-competitive so that more than one research group and also several companies can participate. More often this is a necessity because of the technological uncertainties and the costs involved.

The second phase of the model builds on the business concept that emerges from phase 1 and this concept is tested and the technological

and commercial risks are minimized. This requires further development of product and process technologies by prototyping, specific marketing research, and developing a clearer business case. People from different disciplines and companies must work together in a focused and structured way. Here McKinsey remarks that "though shorter and more focused than the first phase, considerably more recources are typically required".
In this phase the market forces will begin to work and a specific company will take the lead, although we know of many cases where costs and risks are still too high for one company only.

The third phase consists of the commercial development, from production set-up and product-refinement to marketing launch. This demands 'simultaneous innovation': product and process development, marketing and supply chain development. This phase too can be very costly, but here rules the market-place with all known financial possibilities.

Important in the interactive model is that it shows that innovation and knowledge transfer have more dimensions than the linear model can account for. One of these dimensions is the multitude of different expertise and roles in the phases of the process. Within the interactive framework we can easily understand that a complex innovation process may call for a partnership between many different parties, including consultants, agencies and other intermediairies. Speaking about a (national, regional or local) innovation system as Freeman (1988) does, we must be aware of this complex infrastructure, consisting of interlinking networks. But, maybe more important, looking at innovation and transfer of knowledge as interactive processes we understand that these processes are long-term ventures that can only be built on mutual trust and long term commitment at the highest level of the organizations involved. We are certainly not talking about a short term 'just as any other' contract.

Van Terwisga & Van Rosmalen (1992) compared government policies and instruments in relation to the three phases in the model and found

very different roles for government (for example in facilitating technology transfer for SME's), companies and H.E institutions in each phase. They also found that working along the lines of the interactive model can result in successful networks and innovations. Government policies may be very instrumental to the building of successful networks.

3. Trends in networking; Business and higher education

Oerlemans, Dagevos & Boekema (1993) analyze the main reasons for engaging in networking. An important reason is the existence of uncertainties in the market, related to the following developments:

* An increase of productivity by 'market-pull' as well as 'technology-push' factors, resulting in a shortening of the product life cycle
* The existence of new technology-market-product-combinations leading to severe competition (the Unilever vs. Procter & Gamble 'war')
* Diversity in markets and the opening of new markets, leading to greater business uncertainty.

We could add to these developments from our own observations:

* The uncertainty of new technologies and the costs/risks involved in developing them (or the opposite: cost/risks of not participating in their development)
* The nessecity of combining many different technologies or disciplines for innovation, even far beyond the core competences of companies
* The importance of setting worldwide standards in the global market
* The scaling-up of operations, only to be realized through networking

Many companies try to reduce these uncertainties by making strategic choices, one of which is going "back to the core competence" (another choice is merging with other companies but there is a limit to that). To keep on top of a turbulent market with an overview of all the decisive aspects such as research, development, production and sales

(worldwide) is possible only for a few multinationals.
Production processes are unravelled and in parts contracted out to suppliers with specific competences, often through partnerships, strategic alliances or other means of comakership. As Oerlemans et al. clearly observe, the result of this 'internal desintegration' of larger companies is a growing number of relations **between** enterprises. The 'comakership' concept stems from the strengthened relation between companies in a production 'chain'. The strenghtening of the relationship has a quantatitive (the supply of more semi-manufactured products or services) and a qualitative dimension (the supplier takes part in product innovation). In building a network like this, companies reduce the uncertainties we mentioned before through co-operation and sharing specialized expertise in technology and markets.

4. Business-Higher Education partnerships

How do our institutions of H.E. fit into these major trends? Are they not 'main suppliers' of knowledge and technology through their research programs and the education of new generations?
Should they not be important parts of networks with business? As we have already described in the introduction, Dertouzos et al. (1989) warn against the underestimation of the importance of human resources and basic research as becoming a severe obstacle for competitiveness of enterprises in a rapidly changing market.
There are now indeed clear indications that the increasing importance of knowledge as an economic factor next to capital and labour brings a change in strategies of companies (and governments). No longer is co-operation with H.E. institutions just for the sake of 'good feelings', public relations, or a once only contract; but real partnerships are built (see for example OECD 1992 on business-education partnerships).

The similarity between developments in networking in industries and trends we observe in our university-business relationships is striking. The market uncertainties and the turbulent global environment that corporations are faced with and the internal desintegration of larger companies not only lead to a strengthened relationship between

companies in a production chain but also to a new type of relationship with organizations that provide knowledge, technology and human resources. Our university is involved in several, what we call strategic alliances with companies and other partners. Most of these alliances evolved from earlier, short-term, joint projects, contract research or training programs. But these alliances go beyond that and can best be seen as 'focused partnerships' between companies and their 'main supplier' of knowledge. They are based upon similarities in strategies as we will see, not just upon some arbitrarily chosen area of mutual concern.

Experiences that we have, however recent they are, include a wide variety of partners such as the pharmaceutical industry, (semi-government) health care organizations, engineering consultancy firms, regional authorities, and others.

5. Conditions for successful strategic alliances

5.1 Long term objective

A strategic alliance starts with a long-term objective. Both (or more) parties involved share the objective in such a way that they are willing to invest in a process in order to reach that objective.

As said before; an alliance is more then working on a specific project.

5.2 Parallel strategies

Long term objectives are part of a strategy. To make an alliance work, participants have to have parallel (overlapping or complementary) strategies. If one of the participants has to change it's strategy in a major way, it is likely that the alliance will not be successful. Parallel strategies are the basis of joint ventures, of mutual commitment, and of believing in the objective.

5.3 Respect for mission

As we strive in an alliance, participants respect each other's mission and core competences. Our university works at the frontier of basic research and some of our best partners work on the cutting edge of a

global marketplace. Respect for each others missions and understanding of the consequences has to be part of the co-operation.

5.4 A 'joint' history

An alliance always has a history. It builds on earlier experience of a more or less experimental nature. Participants try out ways of co-operation on a limited scale: do we understand each other, what are the intentions, what is the strategy, does the chemistry of two very different cultures work?

5.5 Agreement (not a legal contract!)

If both partners think a match can be made, the actual agreement or letter of intent does not resemble any legal contract whatsoever. An alliance is best made by means of a simple framework consisting of the basic ingredients for co-operation:

- how do we get started
- what do we do to ensure support within both organizations
- how do we monitor and tune the things we do
- who are the liaison-officers
- how do we stop (the exit contract)
- the 'japanese clause': we do not foresee difficulties, but if they appear we will deal with them as follows:... (for example: a committee of three, one member of each participant and an independent 'mediator')

This framework can then be enriched by more specific agreements along the way. In fact the framework invites both participants to extend the co-operation within the objective.

Making an agreement as a fairly simple framework, not using the well known clichés, is in fact a 'litmus test' for the alliance. It is a process where creativity rules and not "paragraph 6, juncto b". Many things are left open that in most common contracts are settled in great detail. Needless to say, the framework is drawn up by or under direct supervision of top-management. Only they can jump forward on the basis of trust and commitment.

6. Regional co-operation

As we explained above, most theories about networking focus on global co-operation and on economic aspects. However, many successful networks where knowledge transfer is involved, seem to be regional.

6.1 What is regional?

How the concept 'regional' is defined, depends largely on the type of co-operation and the goals that are aimed at in the network. For example, with partners in the (vicinity of the) same city as in which the involved university is located, a regional collaboration can be useful with regard to the local home-market and aspects such as logistics and costs. The proximity of the partners in the network makes it easy to meet and to exchange services.

But on the other hand, the region can extend the proximity when the natural partners are situated further away. An example in the situation of our university is a network in which the Veterinary School, the only one in the Netherlands, plays an important role. Next to co-operation with the only agricultural university in our country (Wageningen), the vet schools in Hannover in Germany or in Gent in Belgium are logical partners in the development of the curricula. Another example involves the common interest that defines the natural partners. E.g. the research and policy measures concerning the pollution of the Rhine that is affecting both Germany and the Netherlands, could be a solid base for co-operation between businesses and institutions in the two countries. Further, we see possibilities in co-operation based on common interest in the fields of language and culture, history, sociology, and law.

In Europe, country borders are crossed easily in regional networking, and since Maastricht even these borders are fading. In the U.S. a parallel can be drawn with issues that cross state-borders, such as the pollution of the Mississippi.

So a region can be quite local or crossing state/country borders. The bottomline is a certain proximity that makes personal contacts easy. The closer the partners are located, the easier it is to have an interactive relationship with partners on a high level of co-operati-

on.

6.2 Why regional networking?

There are several reasons why regional networking is very attractive and is more likely to succeed than ambitious networks that involve partners from all over the world.

Firstly, the proximity offers considerable advantages. The cost aspects, the relative ease to arrange the practical details and the fact that less 'cultural' problems (like nationality) will arise, are a few of these advantages.

Secondly, the home market can be an attractive reason for this regional aspect. It is easier to experiment with product innovations and market conditions. In fact, the 'home-market' also forms the necessary home base for try-outs and low-profile experimenting in a well-known market for every multinational before launching new products or services on the global market.

Thirdly, a regional network is a solid base for participation in a global network. Complementary expertise that is already integrated in a regional network forms an attractive partner in a global network. The agreement has already been made, and if the network already exists some time, the success of co-operation between the partners has already been proven. For individual partners in the (regional) network, it also has the advantage of a shared risk.

A fourth reason is that the management of a regional network will be relatively less complicated. In many cases, an overlap with informal networks like the Rotary are involved in the network, which makes communication (informal exchange of information) and mutual understanding easier.

Finally, a somewhat different reason for regional networking involves the regional government and its agencies. Bennett & Krebs (1991) compared several cases of public-private co-operation in the UK and Germany. They found that regional networks of companies, local authorities, H.E. institutions and others on a regional level can work as 'business support systems' to countervail the fragmentation and passivity in government bureaucracy. It is no secret that government

services, programs and subsidies are seldom integrated, not easily accessible etc. Many intermediary agencies appear to focus on the production of services, not hesitating to compete with each other, and seem to be unaware of the needs of their clients. On a regional level however it seems easier to identify common interests and to manage relations for networks in which local and regional authorities participate. These common interests are even more important when we realize that many networks dealing with knowledge and transfer of knowledge are not in the first place structured on economic transactions. Their (initial) structure is more loosely organized and the incentives for co-operation are often 'intangibles' such as social responsibility, peer pressure, the public interest, etc.
That is not to say that these incentives are without value; to build up a network they are needed to bring people together, to overcome 'cultural' differences, to try out new ways of cooperating etc. In such a setting it can be observed that local authorities are willing to 'bend the rules' a little.

7. A revolution in regional networking

In the above, we explained that regional networking is a very useful and powerful way of combining efforts. With regard to knowledge transfer, the role of H.E. institutions cannot be neglected. Universities have to participate in networks with industrial partners and therefore have to adapt their organization to facilitate that co-operation.

In the Netherlands, the structure of the research organization within universities is changing considerably. Universities have to anticipate a changing environment, nationally as well as internationally. Developments in research occur more and more at an interdisciplinary level, the restrictions of the relatively small scale of the country oblige universities to collaborate with partners in the industry or in other countries. Consequently, the traditional disciplinary organization is not suitable anymore.

Nationally, the sources of research funding from the Government are decreasing, so that universities need to gain income from other sources more and more. Figure 4 shows that at least our universty has been successful in that respect with an increase of nearly 50% in five year period.

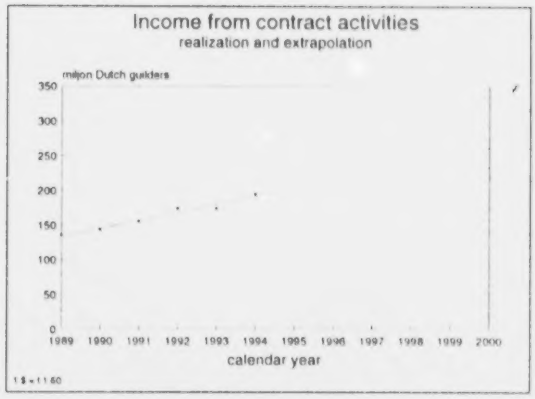

Figure 4: Utrecht University Income from contract activities

Internationally, universities should anticipate a society in which new technologies play an important role. Furthermore, the competition between Europe and Japan, the Far East or the U.S. as well as global issues like the Agenda 21 (Rio de Janeiro) make changes in the scope and organization of research at universities necessary.
International scientific development and a changing society demand an adequate organization and managing structure of science.
This is where the need for international co-operation and successful regional networking come together. Some may say that it is either a global or a regional perspective that H.E. institutions have to strive for. But we have learned that operating on an international scale means that we are faced over and over again, with questions and problems we simply cannot handle on our own. We need our regional partners to be able to play an international role.
An example. Our Research Institute for Marine and Atmospherical Research is well known for its basic research on climate and environmental studies. Although well equipped and staffed, the institute is no match for American and certain European research institutes. To be able to participate in large European and global research programs such as Global Change, the institute needs a much larger scale of operations, including the availability of disciplines such as remote

sensing or aerospacial sciences. This scale is obtained in a regional network with the Royal Netherlands Meteorological Institute and the Health and Environmental Institute, both situated within five miles of our campus. The national government favours this network because it proves to be an excellent opportunity for the Netherlands to be part of a 'megascience' program. In many other areas of research and education our university seeks for similar home based networks as consortia that are strong enough to participate in international programs.

8. Networking and the H.E. mission

Do these developments affect the mission of the university? Do they jeopardize the independent position of the university?
An overall agreement, made by the top management of the partners, makes it possible to define the contours of long-term, complicated research programs enveloping a wide range of projects. Commitment between the top managers guarantees the scope and directon of the agreement. Details can be worked out while working together. The bureaucratic obstacles can be avoided so the real work (research and development) can start without any delay. For our university, it means that researchers can concentrate on their speciality, doing research. The development of long term alliances, deciding on the partners etc. forces the partners to decide on their long-term goals and make their missions explicit. For H.E. institutions this means that they have to make clear choices on how to concentrate the (decreasing) financial means. This process in itself proves to be a reinforcement of the institutional mission.

Utrecht University has made clear choices in the development of its research. For this purpose, in 1987-1989 the university has defined research priority areas. With this active search for research priority areas, research topics and issues that form the core of the university research, faculties and departments were encouraged to formulate their core research areas and to seek collaboration with other faculties as well as with other partners in a broader sense. The development of the

research priority areas lead to the establishment of new independent organizational units, the research institutes. These institutes are formed around a research topic, and are not limited by the traditional boundaries of departments, faculties or universities. Often they include non university research institutes or industrial laboratories. The main characterics are:

- Simple organizational structure that facilitates efficient anticipation on external societal and societal developments;
- Large extent of independency within the boundaries of the five-year program;
- Own budget (assigned for five years by the Faculty Council);
- Scientific Board that is 'outward-bound'.

The recognizable profile, the freedom for the director of the institute to act and react on external developments without having to deal with the traditional bureaucratic system, and the flexibility in co-operation with other universities or enterprises, makes it easier for external partners to find relevant expertise for co-operation. Research institutes form a solid base for regional or national networking. These networks guarantee flexibility in the participation in international networks. The IMAU we mentioned above is an illustrative example of this development.

9. Conclusions

We illustrated that knowledge and knowledge transfer will be a key factor in international competitiveness and that H.E. institutions play, or should play, an important role in national systems of innovations. Recent studies show the importance of co-operation between institutions of H.E, local and regional authorities, and industry. H.E. institutions should play an active role in national and international networks. A solid base is formed by regional networks: the proximity, the common home market, the relatively uncomplicated management of the network make regional networks good partners in global networks. Participation in networks does not affect the H.E. mission in a negative way. On the contrary, it forces H.E. institutions to define their focal points of research and education in a more

explicit way, resulting in a mission extending from abstract formulations about academic freedom to more down to earth, workable definitions, without jeopardizing the academic freedom to teach, to research and to publish the results.

However, it does affect the management structure of the H.E. institution. The traditional structure of faculties and departments is not suitable anymore. We illustrated how the research institutes form an organizational solution. If the managers of H.E. institutions keep their eyes and ears open and are sensitive to the new developments and chances that those developments offer, these institutions have the cances to reinforce their position in society and to contribute to the global issues that will face us in the coming decades.

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